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Phylogenetic analysis of the *Taeniothrips* genus-group, with revision of the species of *Ctenothrips* and *Vulgatothrips* (Thysanoptera, Thripinae)

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Abstract

The pattern of relationships within the *Taeniothrips* genus-group was examined using a morphological phylogenetic analysis. Genera comprising this group are discussed together with some character states used in the analysis. *Taeniothrips* genus-group is recovered as monophyletic, but *Taeniothrips* appears to be polyphyletic. *Ctenothrips* is here interpreted as sister-group to *Vulgatothrips*, with *Ctenothrips smilax* and *C. dissimilis* transferred to *Vulgatothrips*, and *C. niger* synonymized with *C. smilax*. Diagnoses of *Ctenothrips* and *Vulgatothrips* are presented with illustrated keys to distinguish these genera and their included species, and eight species are newly synonymised in *Ctenothrips*.

Key words: cladistic analysis, keys, new synonyms, new combinations, new species

Introduction

The suprageneric classification within the Thysanoptera subfamily Thripinae is far from satisfactory, with a very high proportion of the 230 listed genera monobasic. In an attempt to develop some phylogenetic structure within the subfamily, Mound and Palmer (1981) proposed six genus-groups. Several of these appear to be monophyletic lineages, particularly the *Thrips* and *Frankliniella* groups, but also the *Trichromothrips* group (Masumoto & Okajima 2005), and the *Scirtothrips* group (Masumoto & Okajima 2019). In contrast, the *Anaphothrips* group is probably not monophyletic (Masumoto & Okajima 2017), and this may be true of the *Taeniothrips* group. Members of the *Taeniothrips* genus-group usually exhibit the following features: antennae 8-segmented; relatively long head with genae swollen; ocellar setae I absent; metathoracic spinula absent; posteromarginal comb on tergite VIII with fine and long teeth; discal setae on abdominal sternites absent (Mound & Palmer 1981). Four genera, *Acremonothrips*, *Laplothrips*, *Javathrips* and *Taeniothrips*, were originally placed in this genus-group (Mound & Palmer 1981), of which *Laplothrips* was transferred to *Trichromothrips* genus-group (Masumoto & Okajima 2005) and *Javathrips* was a synonym of *Taeniothrips* (Mirab-Balou *et al*. 2015). According to a phylogenic analysis of Thripidae, Zhang *et al*. (2019b) proposed five more genera, *Amomothrips*, *Ctenothrips*, *Moundinothrips*, *Sciothrips* and *Smilothrips* as members of this group. However, in the process of studying *Ctenothrips*, some species (the *smilax* group, including three species) were found more similar to a monobasic genus *Vulgatothrips* than to the other species in *Ctenothrips* (the *bridwelli* group, including 12 species). This led to a possibility that *Vulgatothrips* also belongs to the *Taeniothrips* genus-group. Moreover, in *Ctenothrips* the *bridwelli* group resembles *Taeniothrips* in head chaetotaxy but differs in lacking mesosternal furca spinula and no mesothoracic sternopleural sutures, and the *smilax* group is related to *Taeniothrips* in an opposite way. These differences are generally significant generic characters in the Thripidae and might be associated with muscles and behavior, which further confuse ideas about relationships between *Ctenothrips* and *Taeniothrips*.

The first objective of the studies presented here was to test the monophyly of the assemblage of genera generally grouped together with *Taeniothrips*, and to examine their possible relationships based on morphological data. The second objective was to examine the structural variation amongst the species described in the genus *Ctenothrips*, and to determine how that variation might affect generic relationships amongst the *Taeniothrips* group.

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In order to evaluate the significance of the named species of *Ctenothrips*, and to better understand the relationships of this genus to genera similar to *Taeniothrips*, specimens of a range of species and genera were borrowed from various museums. In particular, slide-mounted specimens of almost 200 females and over 50 males of the 15 described species of *Ctenothrips* were accumulated. A data matrix of morphological characters was then prepared based on the available specimens, and a phylogenetic analysis performed.

Genera associated with *Taeniothrips*

The genera discussed below comprise the *Taeniothrips* genus-group of Mound and Palmer (1981), also the genera of the *Taeniothrips*-clade of Zhang *et al*. (2019b). *Ayyaria* and *Vulgatothrips* are included for resemblance to members of *Ctenothrips* with highly reticulated body structure, and *Tenothrips* is still included for its similarity with *Taeniothrips*.

Acremonothrips is a monotypic genus with the only species recognized by the extraordinarily long antennal sense cones. Specimens of this genus were not available for study, the limited characters chosen for the analysis were based on Hood (1925) and Priesner (1939).

Amomothrips is a monobasic genus remarkably similar in appearance to *Taeniothrips*, with the differences being the presence of ocellar setae pair I and duplication of ocellar setae II (Mound *et al*. 2012; Zhang *et al*. 2019b), and well-developed setae on the head and pronotum.

Ayyaria is another monobasic genus that show similarities to *Ctenothrips*, such as tergites and sternites with reticulations and tergite VIII with a complete comb. However, according to Zhang *et al*. (2019b) these genera might not be related. They also differ in their host associations, with *Ayyaria* usually found on Fabaceae leaves.

Ctenothrips might be related to *Taeniothrips* in sharing several character states such as the form and chaetotaxy of the head, a long comb on tergite VIII, and a strongly convex posterior margin to sternite VII in females with setae S1 and S2 distant from this margin (Zhang *et al*. 2018). However, species in the genus seem to form two groups as indicated above. The consistent differences make diagnosis of this genus difficult. Also difficult is assessment of the importance of some character states, such as pairs of ocellar setae, the mesosternal furca spinula, and the mesothoracic sternopleural sutures.

Moundinothrips shares with *Ctenothrips* the presence of fully reticulate tergites and sternites, also a long and complete comb on tergite VIII. However, based on observations by Bhatti (1995), this genus is possibly not related because of the following character states: presence on antennal segment I of a pair of dorso-apical setae; pronotum with one pair of posteromarginal setae; mesosternum and metasternum both with an endofurca spinula; sternite VII of female with only two pairs of marginal setae (Bhatti 1995).

Sciothrips includes a single species. This is superficially similar to species of *Taeniothrips* but is distinguished by the presence of prominent posteromarginal microtrichial teeth laterally on the tergites, and the absence of microtrichia on antennal segments III–VI.

Smilothrips is superficially similar to *Ctenothrips* species by ocellar setae pair I absent, mesosternum and metasternum both without spinula, fore wing (if present) first vein with complete setal row, tergites reticulate and sternite VII with setae S1 & S2 in front of margin. The single species in this genus differs in having the antennae 7-segmented, and the mesosternal sternopleural sutures present. However, these character states also occurred within some *Ctenothrips* species.

Taeniothrips shares several character states with *Ctenothrips*, including: ocellar setae III situated inside ocellar triangle; antennal segment I without paired dorso-apical setae, segments III and IV with forked sense-cones; pronotum with two pairs of long posteroangular setae (Fig. 11); tergites without ctenidia or craspeda, VIII with complete long posteromarginal comb and sternite VII with S1 and S2 in front of margin. Zhang *et al*. (2018) suggest *Ctenothrips* differs in having tergites with strongly reticulated sculpture, and the fore wing setal rows almost complete on both longitudinal veins. However, *Taeniothrips picipes* and *T. major* also have tergites with weakly reticulate sculpture, and the fore wing of some specimens of *C. transeolinae* have a clear short gap in the first vein setal row.

Tenothrips is a poorly defined genus that includes nine species found mainly in Europe and North America. Species in this genus might be similar in structure to *Ctenothrips niger*, but with a smaller body size and shorter head, and lacking obvious reticulations on the tergites.

Vulgatothrips was based on a single species, whose relationships have remained far from clear (Zhang *et al*. 2018). It was not considered related to *Taeniothrips* because of the presence of three pairs of ocellar setae, but it is included here because of its similarities to some species of *Ctenothrips*.

Discussion of some character states in these genera

1. *Antennae segment number*: 9-segmented antennae is considered plesiomorphic in Thysanoptera (Mound *et al*. 1980), but in Thripidae the number of antennal segments is unreliable as an indicator of relationships (Zhang *et al*. 2019a). Among the species involved in this analysis, most are 8-segmented, but *Smilothrips productus* and *Ctenothrips dissimilis* have 7-segmented antennae, and an occasional specimen of *C. distinctus* has antennal segments VII–VIII partly fused.

2. *Microtrichia on antennal segments III–VI*: most species of Thripinae have microtrichia on the surface of antennal segments III–VI, and a few species recorded without antennal microtrichia are all associated with grasses, such as *Sciothrips cardamomi*. Species of Panchaetothripinae usually lack microtrichia on antennal segments III–VI, at least on the dorsal side, for example *Helionothrips aino*.

3. *Antennal sense cones*: in the genera list above, antennal segments III–IV consistently have forked sense cones shorter than the length of their segment, but *Acremonothrips* was described with unusually long sense cones on antennal segments III–IV (Priesner 1939).

4. *Eye pigmented facets*: species of Aeolothripidae never have pigmented eye facets, but species in many genera of Thripidae have pigmented eye facets ventrally. However, the function of these facets is not clear, and the number of such facets can be difficult to decide on slide-mounted specimens. Only *Ayyaria* and *Tenothrips* species have pigmented eye facets among the genera considered here.

5. *Ocellar setae pair I*: the presence or absence of this pair of setae is generally consistent among species in most genera of Thripinae, even in genus-groups (Mound & Palmer 1981). Exceptions are known only amongst a few species in larger genera, including *Frankliniella*, *Iridothrips* and *Chaetanaphothrips*. In the genera considered here, these setae are stable within each genus except in *Ctenothrips.*

6. *Ocellar setae pair III*: the size and position of these setae is variable among taxa but generally stable within species. However, among populations of *Ctenothrips bridwelli* both the length and the position of these setae are variable.

7. *Postocular setae*: species of Thripinae generally have six pairs of postocular setae arranged in a regular line behind the eyes, although sometimes one or two pairs are missing or displaced posteriorly behind the setal row.

8. *Maxillary palps 3-segmented*: the plesiomorphic condition is considered to be three segments. The genera considered here all have 3-segmented maxillary palps, except for *Ayyaria* in which the distal segment bears median setae that create an apparent 3-segmented condition.

9. *Pronotal setae*: in the genera considered here, all species have two pairs of long posteroangular setae, but the number of discal setae varies considerably.

10. *Metanotum median pair of setae* (Fig. 22): in species of *Taeniothrips* these setae are always on the anterior margin, whereas in species of other genera they are generally behind this margin. The position and distance between these setae are variable in *Ctenothrips niger* (Hu & Feng 2013; Tyagi *et al*. 2014), possibly in association with wing length.

11. *Mesosternal sutures* (Fig. 25): the presence or absence of these sutures presumably represents significant differences in body structure and behavior, but has no obvious correlation either with the presence of any endofurcal spinula or with wing form. In *Ayyaria* a spinula is present on both endofurcae but without any indication of mesosternal sutures. Among *Ctenothrips* species the mesosternal sutures as well as both endofurcal spinulae are absent. The significance and function of the mesosternal sutures in Thripidae requires further study.

12. *Mesosternum and metasternum endofurcal spinula*: these structures are variable both within and between species of *Stenchaetothrips* and *Iridothrips*, and this variation may sometimes be associated with body maturity (Mound *et al*. 2017; Wang *et al*. 2019). However, a well-developed mesosternal spinula is present consistently among species of *Taeniothrips* (Fig. 25). Among the genera included in the analysis below, both spinulae are present in *Moundinothrips*, whereas both are absent in *Smilothrips*. But these two genera are monobasic, and were proposed for unique characters including the state of the endofurcal spinula.

13. *Fore wing vein setae*: macropterous and micropterous individuals have been found both in *Ctenothrips* and *Vulgatothrips*, and this variation in wing length and hence number of setae, makes the number of vein setae of limited importance. Although *Ctenothrips* species are commonly considered to have a complete row of setae on the first vein, most examined specimens in this genus have a short gap in this row on the distal half, and in *C. transeolineae* the gaps are particularly obvious (Fig. 30).

14. *Tergal sculpture*: the presence of strong polygonal reticulations on the abdominal sclerites has been regarded as distinctive of *Ctenothrips* among Thripinae genera (Fig. 43) (Zhang *et al*. 2018). Only a few other genera are known to have such strong reticulations, including *Ayyaria* and *Moundinothrips*. However, *Smilothrips productus* and *Vulgatothrips shennongjiaensis*, also *Taeniothrips major* and *Ta. orionis* have quite strong reticulations on the tergites and sternites (Fig. 39). Species of *Taeniothrips* (except *major* and *orionis*) generally are without sculpture between the tergal median setae (Fig. 40), and species of *Tenothrips* have no sculpture on tergites III–VII between the median setae (Fig. 42). These sculpture differences might be worth further study.

15. *Tergite VIII posteromarginal comb*: presence of this comb of microtrichia is a derived condition that occurs only amongst the three most highly derived families of Terebrantia, Adiheterothripidae, Heterothripidae and Thripidae; it is thus presumably plesiomorphic for Thripidae. It is found in all four subfamilies, but among Thripinae the comb is often reduced medially, or completely absent.

16. *Microtrichia on tergite VIII around spiracle*: species of *Thrips* genus-group and *Frankliniella* genus-group have a row of regular microtrichia forming a pair of ctenidia, but amongst most Thripinae, these microtrichia are irregular or not obvious or completely absent.

17. *Tergite X*: the genus *Ctenothrips* has been diagnosed as having tergite X long and tube-like (Xie *et al*. 2011, 2013), but the length and shape of this segment is dependent on slide-mounting, and the original illustration of *C. yangi* clearly has tergite X tapering (Xie *et al*. 2013).

18. *Sternite VII median and submedian setae*: species in *Taeniothrips* generally have these two pairs of setae in front of the posterior margin, and the median setae further apart (Fig. 51). But in *Vulgatothrips* the median and submedian setae are rather closer to each other (Fig. 52), and in the type species of *Ctenothrips* (Fig. 50) the median pair of setae S1 are wide apart, and setae S2 arise midway between S1 & S3.

19. *Male pore plate*: males of Thripinae generally have these structures on abdominal sternites III–VII (Mound 2009), or on several posterior sternites. The presence of pore plates only on sternites III–IV is shared only with three other genera of Thripinae (Mound 2009).

20. *Male tergite IX median setae*: the chaetotaxy on tergite IX often provides useful characters to distinguish species in several families of Terebrantia. These setae presumably play some role in mating, but as many species are known only from females, the importance of these male character states is difficult to assess.

Material and methods

Examined specimens were slide-mounted in Canada balsam and slide label information is listed in Appendix 1. Observations were made with a Nikon Eclipse 80i phase contrast microscope, and the illustrations taken through a Leica DM 2500 microscope with DIC illumination using automontage software. Nomenclatural details of the taxa discussed here are available in ThripsWiki (2019).

Abbreviations for museum collections:

ANIC (Australian National Insect Collection, CSIRO, Canberra); BMNH (The Natural History Museum, London); CAS (California Academy of Sciences, San Francisco); NMNH (National Museum of Natural History; Washington, DC); NWAFU (Northwest Agricultural and Forest University, Yangling); NZMC (National Zoological Museum of China, Beijing); TARI (Taiwan Agricultural Research Institute); SCAU (South China Agricultural University, Guangzhou); SMF (Forschungsinstitut und Natur-Museum Senckenberg, Frankfurt); UASM (University of Alberta E. H. Strickland Entomological Museum); YAU (Yunnan Agricultural University, Kunming).

Phylogenetic analysis

The analysis presented here is based on 29 species in 10 genera of Thripinae (Appendix 1). The Panchaetothripinae species *Helionothrips aino* was chosen as the out-group. *Ayyaria chaetophora*, *Tenothrips frici*, *Vulgatothrips shennongjiaensis* were included because these genera share character states with members of *Taeniothrips* as discussed above. Amongst the eight genera of *Taeniothrips* genus-group, only *Ctenothrips* and *Taeniothrips* contain more than one species, the type species of *Taeniothrips* was included together with five more species of which specimens were available; all species in *Ctenothrips* were included because the types of each species were checked, and species relationships in *Ctenothrips* need study.

Characters were scored from the external morphology of adult females and males, with 64 characters recorded on adult females from the head (21, 30.8%), thorax (20, 29.4%), and abdomen (23, 33.8%), plus four characters from males. A complete list of these character states is given in Appendix 2, with character matrix given in Appendix 3. All characters were treated as unordered and with equal weight.

The analysis was performed in TNT ver. 1.1 (Goloboff *et al*. 2008) with implicit enumeration. Parsimony analysis was done holding 99999 trees in the memory. The 'traditional search' was settings of 900 replicates, tree bisection reconnection (TBR) branch swapping, saving 45 trees per replicate and a random seed of 0.

A strict consensus of the maximum parsimonious trees (MPTs) was generated in Winclada v.1.0 (Nixon 2002). Bremer support values were calculated with the function implemented in TNT (TBR from existing trees, retain trees sub optimal by 10 steps), the branch support values were calculated with the function implemented in TNT (tree bisection and reconnection, from existing trees, retain trees suboptimal by 10 steps), as well as bootstrap values (standard, absolute frequencies, collapse groups < 51), both Bremer support and bootstrap values are mapped on the strict consensus tree (Fig. 1). Character states were mapped on a maximum parsimonious tree (MPT), showing only unambiguous changes.

Results and discussion

Analysis with TNT produced four most parsimonious trees, the strict consensus tree (Fig. 1, with length =218, consistency index =0.45 and retention index =0.67) of the four MPTs in WINCLADA collapsed 6 nodes. Bremer support values (B) and bootstrap values (BS) are presented on the strict consensus tree.

Our analysis partly conforms to the results of Zhang *et al*. (2019b), with *Ayyaria* diverging very early within the studied group and the other genera forming one clade (BS=53/B=2). *Tenothrips* lacks any satisfactory generic diagnosis, and it is not included in this genus group. The species studied here, *Tenothrips frici*, might resemble a member of the *Taeniothrips* genus-group, but based on the results of Zhang *et al*. (2019b), a close relationship with other Thripinae taxa cannot at present be discarded. The members of *Acremonothrips, Amomothrips, Ctenothrips, Moundinothrips, Sciothrips, Smilothrips, Taeniothrips* and *Vulgatothrips* are here interpreted as forming the *Taeniothrips* genus-group, supported by four synapomorphies: head as long as wide or longer than wide (0:1); head with projection in front of eyes (1:1); eyes without pigmented facets (3:0) and tergite VIII comb arising from margin (49:0).

Ctenothrips is clearly not monophyletic, with the species well resolved as two groups. *Vulgatothrips shennongjiaensis*, *C. niger*, *C. smilax* and *C. dissimilis* form one clade, strongly supported by (BS=95/B=4): head without projection between eyes (1:0); 3 pairs ocellar setae present (4:1); ocellar setae III as long as distance between hind ocelli (7:1); postocular setae IV longer than ocellar setae pair III (13:2); setae on segment VI all situated in distal half (20:0); metanotal CPS on posterior third (33:1); sternite VII with S2 close to S1 (62:0); male with pore plate on sternites III–IV (67:2). Therefore, the relevant species are transferred to *Vulgatothrips*.

The other members of *Ctenothrips* clearly form a separate clade that is well supported by (B=2): postocular setae have the same length, no setae particularly longer or shorter (12:0); metanotal median setae as long as submedian setae (31:1); mesosternum suture absent (34:0) and furca spinula absent (36:0); tergite VIII with group of microtrichia in front of spiracle absent (50:0). However, the relationships among these genera are poorly resolved, possibly because the number of selected characters coded here were small and based mainly on generic differences (Buckman *et al*. 2013; Zhang *et al.* 2019b). In three of the four most parsimonious trees, the relationships among species are indicated as in Appendix 4: with 7 species from China (*cornipennis*, *guizhouensis*, *kwanzanensis*, *leiono-*

tus, *nonnae*, *taibaishanensis*, *yangi*) forming one clade; *transeolineae* and *barapatharensis* are closely related and strongly supported (BS=87/B=2). Detailed discussion about synonymy of these names is given under *Ctenothrips* below.

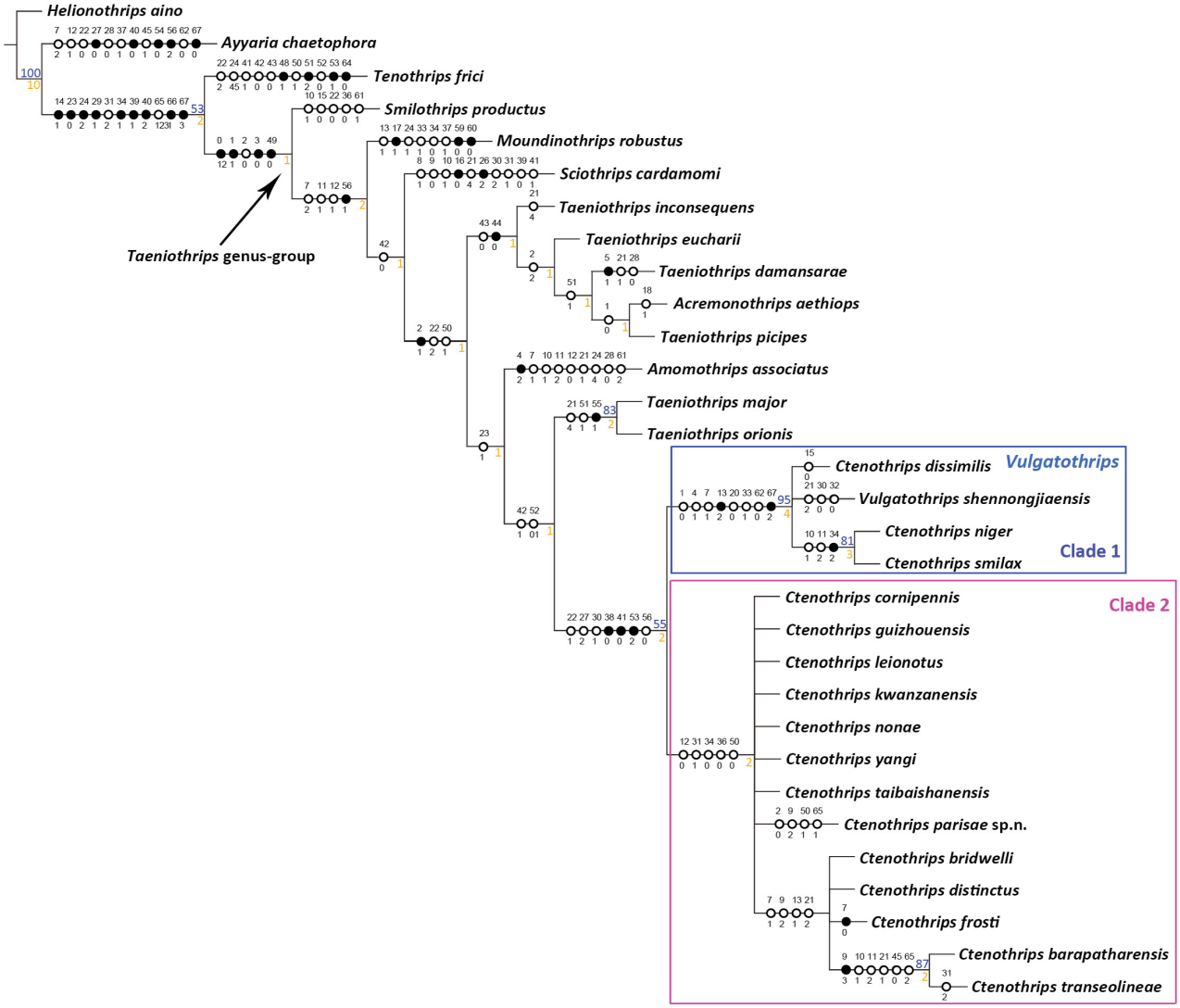


FIGURE 1. Strict consensus of four most parsimonious trees. (Tree generated from morphological phylogenetic analysis, unambiguous apomorphies mapped on branches, black circles indicate nonhomoplastic changes; bremer support values and bootstrap mapped near the nodes below and above branches respectively).

Despite the many differences, the clade of *Vulgatothrips* is supported as sister group to the clade of *Ctenothrips* (BS=55/B=2) by three synapomorphies [fore wing first vein setae almost complete (38:0); tergites I sculpture fully reticulate (41:0); tergite X longer than IX (53:2)] and four homoplastic characters [pronotum with 1-10 discal setae (22:1); mesonotum polygonally reticulate (27:2), metanotal median setae on or close to anterior margin (30:1), tergite VIII shorter than VII (51:0); tergite X longitudinal split complete (56:0)].

The genus *Taeniothrips* was recovered as not monophyletic, with *Ta. major* and *Ta. orionis* hardly distinguished from each other and not related to the other members of the genus. Two European species, *Ta. picipes* and *Ta. inconsequens*, two Southeast Asian species, *Ta. damansarae* and *Ta. eucharii* (the latter is now widespread), together with *Acremonothrips aethiops* form a clade supported by two tergite sculpture characters: 43:0 and 44:0. This is possibly because the genus *Taeniothrips* remains diagnosed more on plesiomorphies than on apomorphies. It may be relevant that more than 30% of the species listed in *Taeniothrips* now are known only from fossils (ThripsWiki 2019). Although according to the analysis *Acremonothrips aethiops* is apparently a member of *Taeniothrips*, no synonymy is proposed due to the lack of information and unavailable specimens.

Taxonomy

Key to distinguish *Ctenothrips* from *Vulgatothrips*

1. Ocellar setae pair I absent (Fig. 2); mesosternal endofurca without spinula, mesosternal sternopleural sutures absent (Fig. 4); males with pore plate on sternites III–VIII (Fig. 45) . . . . . *Ctenothrips*

-. Ocellar setae pair I present (Fig. 6); mesosternum with spinula and mesosternal sternopleural sutures present (Fig. 26); males with pore plate on sternites III–IV (46) . . . . . *Vulgatothrips*

Ctenothrips Franklin

Ctenothrips Franklin, 1907: 247. Type species: *C. bridwelli* Franklin.

This genus was erected for a single species based on five females from a site just north of Boston in North America, and about 20 years later a second species was described based on a single short-winged female that was taken just West of Boston (Moulton 1929). We conclude below that these two represent a single species that is widespread in the area between New Hampshire, Tennessee and Alberta. In contrast, the other 13 species currently listed in this genus are all from Eurasia (ThripsWiki 2019). One is widespread across the Palaearctic, one is known only from alpine Japan, three are from the Himalayan mountain areas in Nepal and India, and eight are from China. Unfortunately, most of these species were described by authors without personally examining specimens of previously described species. Many descriptions were based on few specimens (see Table 1), and some were damaged when mounted onto slides (Figs 53–57, 64–66). However, useful taxonomy of phytophagous thrips needs to be based on adequate samples, together with reliable host-plant records. Xie *et al*. (2011) drew attention to the resultant confused situation by producing a key to 12 species, of which information concerning 10 species was drawn solely from published literature. The structure of that key revealed the weakness of several character states that had been used to diagnose several species, including pronotal surface sculpture and varying shades of yellowish-brown on antennal segments. Given the lack information concerning the identity of the plant species on which these insects live, and the inadequate morphological distinctions used, there is good reason to query the taxonomic significance of some of the species described in *Ctenothrips*.

According to the analysis results above, three names should be transferred to *Vulgatothrips*, 13 names are now left in *Ctenothrips* (clade 2 in Figure 1). Although most species were known from limited specimens with weak host plant information, study of the extensive available slide collections (Appendix 1) suggests some possible host associations. *Ctenothrips bridwelli* is associated with leaves of certain Liliaceae and Orchidaceae; the Palaearctic species, *C. distinctus*, is associated with *Convallaria majalis* (Asparagaceae), another lily-like plant; a new species from China is described below from another member of the Liliales, *Paris yunnanensis* (Liliaceae); and *nonnae* from Japan was known from *Paris japonica*. Although the other nine species were taken from unrelated plants, *yangi* was described as breeding on various different plants, *Bryophyllum* (Crassulaceae), *Oxalis* (Oxalidaceae), *Glycine* (Leguminosae), *Pilea* (Urticaceae), *Mentha* (Lamiaceae) and also *Paris*. This polyphagous feeding habit may be related to the variation in structural characters that we record below among the available samples of adult *Ctenothrips* specimens.

Diagnosis: Macropterous or micropterous. Head longer than wide or as long as wide, constricted behind eyes; maxillary palps 3-segmented; eyes without pigmented facets and not longer than length of cheek; ocellar setae I absent. Antennae 8-segmented, segment I without paired dorso-apical setae, III and IV with forked sense cones. Pronotum wider than long; two pairs of long posteroangular setae, one or two pairs of posteromarginal setae present. Mesonotum reticulate, median pair of setae situated near middle; campaniform sensilla present anteromedially. Metanotum reticulate; median setal pair behind anterior margin; campaniform sensilla present (Fig. 22). Fore wing vein setal rows complete or first vein with short gaps; clavus with five veinal and one discal setae; posterior fringe cilia wavy (Fig. 31). Prosternal ferna not divided; basantra membranous, without setae; prospinasternum broad and transverse. Mesosternum without sternopleural sutures, meso- and metasternal endofurca without spinula (Fig. 24). Tarsi 2-segmented. Abdominal tergites reticulate, III–VII posterior margin without ctenidia or craspeda (Fig. 44); VIII with complete posteromarginal comb; IX with two pairs of campanifom sensilla; X with median split com-

plete. Sternites reticulate, III–VII with three pairs of posteromarginal setae, II with two pairs posteromarginal setae, VII with S1 and S2 far from margin (Fig. 50). Pleurotergites without discal setae. Male similar to female; sternites III–VIII each with oblong pore plate (Fig. 45).

TABLE 1. Information of type specimens of *Ctenothrips* species

Species	Holotype	Paratype	Locality	Associated plants	Plant family	Type or Reference
Ctenothrips barapatharensis	1♀	2♀	Himachal Pradesh, India	?	Ferns	Tyagi 2014
Ctenothrips bridwelli	1♀	5♀	NH, USA	*Symplocarpus*	Araceae	Franklin 1907
Ctenothrips cornipennis	1♀	2♀	Chongqing, China	?	?	Han 1997
Ctenothrips distinctus						
Ctenothrips frosti	1♀		MS, USA	?	?	Moulton 1929
Ctenothrips leionotus	1♂	2♀	Hubei, China	grasses	Poaceae	Tong & Zhang 1992
Ctenothrips guizhouensis	1♀	20♀	Guizhou, China	*Galium*	Rubiaceae,	Xie *et al.* 2011
Ctenothrips kwanzanensis	1♀	1♀	Taiwan, China	?	Compositae	Takahashi 1937
Ctenothrips nonnae	1♀	19♀	Japan	*Paris*	Liliaceae	Haga & Okajima 1989
Ctenothrips taibaishanensis	1♀	1♀1♂	Shaanxi, China	?	?	Feng *et al.* 2003
Ctenothrips transeolineae	1♂	1♀1♂	Taiwan	grass	Poaceae	Chen 1979
Ctenothrips yangi	1♀	18♀10♂	Yunnan, China	*Bryophyllum*	Crassulaceae	Xie *et al.* 2013
Ctenothrips dissimilis	1♀	9♀2♂	Shaanxi, China	*Spiraea*	Rosaceae; Poaceae	Hu & Feng 2014
Ctenothrips niger	1♀	2♀	Nepal	?	?	Kudô 1977
Ctenothrips smilax	1♀	4♀	Bhaderwah, India	?	Ferns	Bhatti 1976

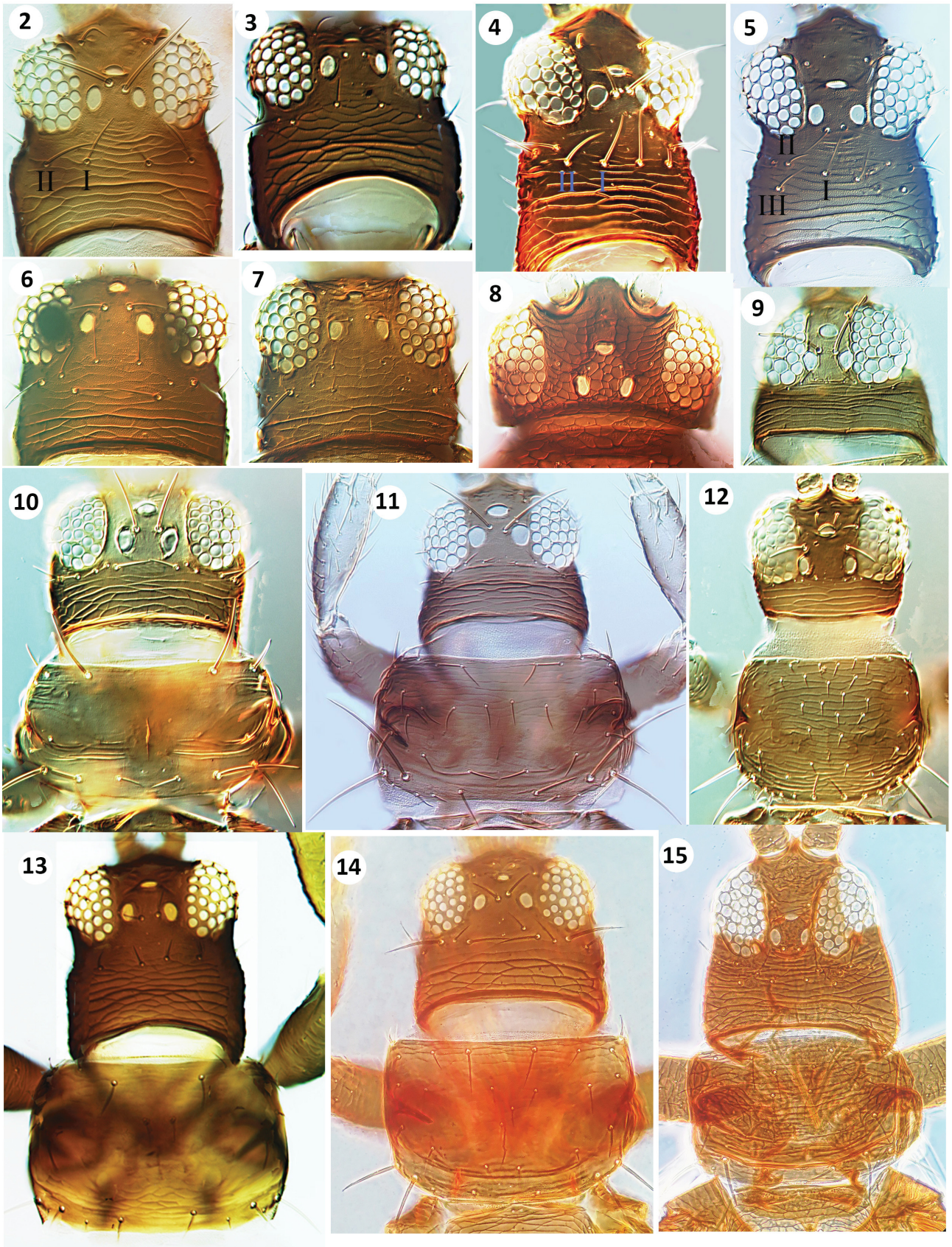
Key to *Ctenothrips* species

1. Postocular setae not arising in a single row, pair II slightly in front of pairs I & III, pair III arranged far behind I & II (Fig. 5); ocellar setae pair III arising posterior to ocellar triangle; pronotum with transverse lines; male with one pair of thorn-like setae on tergite IX (Fig. 49). . . . . *transeolinae* [southern China and northern India]

-. Postocular setae arising almost in a row; pair III missing (Fig. 2); ocellar setae pair III arising within ocellar triangle, at least in front of posterior margin of hind ocelli; pronotum without obvious sculpture, sometimes with a few weak reticulations; male tergite IX with 2 pairs or no thorn-like setae 2

2. Male tergite IX with two pairs of thorn-like setae (Fig. 48), the upper pair longer; female body about 2.8 mm long; pronotum generally with one pair of posteromarginal setae, occasionally 2 pairs (Fig. 19) . . . . . *parisae* **sp.n** [southwest China]
-. Male tergite IX without thorn-like setae (Fig. 47); female body no more than 2.7 mm long, usually 2.0–2.3 mm; pronotum with two pairs of posteromarginal setae 3

3. All coxae and femora brown, tibiae and tarsi yellow (Fig. 28); ocellar setae III short, generally as long as postocellar setae (Fig. 4); pronotum generally with reticulations (Fig. 16, 17) . . . . . *distinctus* [Europe]
-. All coxae, femora and tibiae completely brown (Fig. 27), tarsi yellow; ocellar setae III as long as or longer than postocellar setae; pronotum without obvious reticulations (Fig. 13) . . . . . *bridwelli* [North America]
-. Coxae and femora brown, tibiae yellowish brown with apex paler, tarsi yellow; ocellar setae III usually longer than postocellar setae (Fig. 2); pronotum without obvious reticulations . . . . . *kwanzanensis* [China, Korea, Japan]



FIGURES 2–15. Characters on head & pronotum. 2–9 Head: **(2)** *C. kwanzanensis*; **(3)** *C. distinctus*; **(4)** *C. parisae*; **(5)** *C. transeolineae*; **(6)** *V. smilax*; **(7)** *V. dissimilis*; **(8)** *H. aino*; **(9)** *Ta. damansarae*. 10–15 Head and pronotum: **(10)** *Ay. chaetophora*; **(11)** *Ta. eucharii*; **(12)** *Te. frici*; **(13)** *C. bridwelli*; **(14)** *V. shennongjiaensis*; **(15)** *C. transeolineae*.

Ctenothrips bridwelli Franklin

Ctenothrips bridwelli Franklin, 1907: 248.
Ctenothrips frosti Moulton, 1929, **Syn.n.**
(Figs 13, 27, 50, 53)

Originally described from Dover, New Hampshire, this species has been recorded from many other States in USA, including NY, VT, MA, IL, MD, CT, TN, also Alberta and Québec, Canada (Blanton 1939; Crawford 1939; Diffie *et al*. 2008; Light & Macconaill 2011). An extensive collection, including full and short-winged individuals within populations, was studied (Appendix 1), and the following variations observed: ocellar setae pair III shorter than or as long as postocular setae (Fig. 13), or even much longer and almost as long as the pronotal posteroangular setae; ocellar setae pair III arising anterior to hind ocelli, between hind ocelli, or just near posterior margin of hind ocelli; tergite VIII median setae in front of campaniform sensilla, or posteromedian to campaniform sensilla; antennal segments III–V completely yellow varying to segments IV–V shaded on distal half.

The holotype of *frosti* was studied, which is a short-winged female in bad condition (Fig. 54). We concluded that it does not differ significantly from other short-winged specimens of *bridwelli*. The completely dark tibiae of *bridwelli* is the only reliable distinction between this species and the European *distinctus*. A few specimens from Tennessee have been studied with yellowish brown tibiae, but these specimens may not have been fully mature.

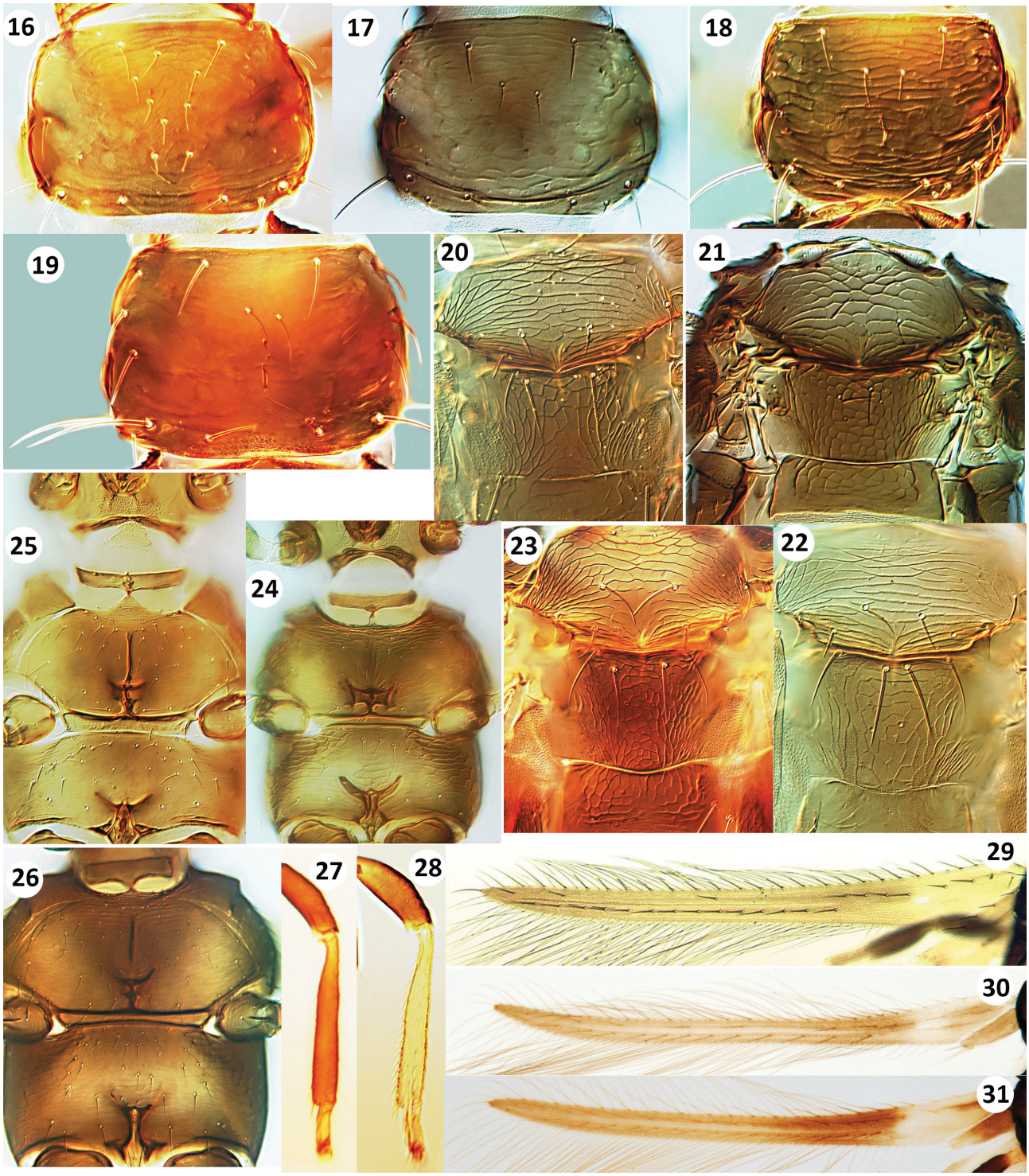
Material examined: CANADA, Alberta, Edmonton, 12 females, 4 males from *Lilium* leaves, 11.ix.1979 (B.S. Heming); **Québec**, Gatineau Pk., 4 females, 4 males from *Epipactis helleborine*, 28.viii.2009; 1 female from *Trillium grandiflorum*, 24.vi.2008 (M. Light). **USA, Connecticut**, Bridgeport, 3 micropterous females from leaves, 24.vii.1913 (H.M. Russell); **Illinois**, Muncie, 4 females from green-dragon leaves, 25.vii.1908 (C.A. Hart); Urbana, 1 female from *Trillium recurvatum*, 11.v.1907 (C.A. Hart); **Vermont,** Northfield, 2 females from *Caulophyllum thalictroides*, 31.vi.1992 (M. Skinner); **Massachusetts**, Sherborn, holotype female of *frosti*, 24.iii.1928 (C.A. Frost); 1 female from Skunk cabbage, 23.iv.1955 (Chapin); **New York**, 2 females, 1 male from *Lilium*, 2.viii.1939 (E.P. Imle); 1 female from *Polygonatum*, 6.viii.1930 (J.D. Hood); 2 females from *Podophyllum*, 30.v.1924 (J.D. Hood); 1 male, 14.x.1930 (E.A. Maynard);1 female, 27.v.1938 (J.C. Bradley); **Washington**, 5 females from *Trillium*, 6.iv.1913 (J.D. Hood); **Tennessee,** 5 females from *Trillium* (Ainslie), 1 female, xi.2001.

Ctenothrips distinctus (Uzel)

Physopus distincta Uzel, 1895: 121.
(Figs 3, 16, 17, 21, 24, 28, 31, 44)

This species has been recorded widely in northern Eurasia, from Finland, Sweden, Netherlands, Germany, Switzerland, Slovakia, Ukraine, Siberia, to Vladivostok and Korea (Kucharczyk & Kucharczyk, 2008; Kudô, 1977), also Shandong province in China (Han 1997). However, the collecting record from China might be unreliable, because Han (1997) described the species as having a mesosternal spinula, whereas *distinctus* has no mesosternal spinula (Fig. 24). This species was described with obvious reticulate sculpture on the pronotum (Fig. 16), but visibility of these reticulations is highly dependent on the quality of slides, and the pronotal median area is always without sculpture (Fig. 17). In the present study, specimens collected in Europe from Norway, Poland, Germany and Austria were studied, and all of them have dark brown femora and yellow tibiae (Fig. 28). In contrast, specimens from Vladivostok and South Korea have the tibiae yellowish brown. The distribution of *distinctus* extends across the Palaearctic from Europe to Siberia and possibly as far east as Vladivostok, and the distribution of *bridwelli* extends across the Nearctic from Boston to at least as far as west as Alberta. There thus seems to be a possibility that these colour variants represent a single Holarctic species that exists as a Holarctic circum-polar cline.

Material examined: **AUSTRIA**, 2 females from *Convallaria*, viii.1960 (H.P. Blütter). **GERMANY**, **Rhineland**, Leverkusen, Berg Neukirchen, 2 males from *Convallaria majalis*, 17.viii.2001 (M. Boness). **NORWAY**, 14 females, 5 males from *Convallaria majalis* also 8 females, 2 males (S. Kobro). **POLAND**, 2 females, 11.vi.2018 (H. Kucharzyk). **RUSSIA**, **Vladivostok**, 2 females from *Urtica*, 5.v.2012 (A. Wells). **SOUTH KOREA**, 3 females and 1 male from *Lilium* leaves, 8.viii.2009 (H. Kurahashi). **CHINA, Jilin**, 2 females and 1 male from *Rhododendron*, 13.ix.2015 (J. Wang).



FIGURES 16–31. Characters on thorax. 16–19 pronotum: **(16)** *C. distinctus*; **(17)** *C. distinctus*; **(18)** *C. transeolineae*; **(19)** *C. parisae*. 20–23 Meso-and metanotum: **(20)** *V. shennongjiaensis*; **(21)** *C. distinctus*; **(22)** *Ta. eucharii*; **(23)** *C. parisae*. 24–26 Meso-and metasternum: **(24)** *C. distinctus*; **(25)** *Ta. eucharii*; **(26)** *V. smilax*. 27–28 Hind leg: **(27)** *C. bridwelli*; **(28)** *C. distinctus*. 29–31 Fore wing: **(29)** *Ta. orionis*; **(30)** *C. parisae*; **(31)** *C. distinctus*.

Ctenothrips kwanzanensis Takahashi

Ctenothrips kwanzanensis Takahashi, 1937: 339.
Ctenothrips nonnae Haga & Okajima, 1989: 49. **Syn.n.**
Ctenothrips leionotus Tong & Zhang, 1992: 48. **Syn.n.**

Ctenothrips cornipennis Han, 1997: 539. **Syn.n.**
Ctenothrips taibaishanensis Feng, Zhang & Wang, 2003: 175. **Syn.n.**
Ctenothrips guizhouensis Xie, Zhang& Li, 2011: 66. **Syn.n.**
Ctenothrips yangi Xie, Yuan, Li & Zhang, 2013: 611. **Syn.n.**
(Figs 2, 36–38, 43, 47, 54–59)

This species was described from two females collected in the mountain areas of Taiwan. The description stated that there were three pairs of pronotal posteromarginal setae, and that antennal segment III was as long as segment IV. However, we have examined the type specimens and found only two pairs of pronotal posteromarginal setae, and antennal segment III longer than IV. These corrected character states were clear in the illustration published by Wang (2002).

- C. nonnae was described from a series of females collected from mountain areas in Japan (Fig. 59). It was distinguished from the description of *kwanzanensis* by its larger body, and antennal segment III longer than IV. However, as indicated above, the original description of the antennae of *kwanzanensis* was incorrect, and specimens of *kwanzanensis* have the body ranging in size from 1850 to 2200 microns, overlapping the size of *nonnae* that has been studied.

- C. leionotus (Fig. 56) was described from a male holotype and two females, all of which are severely compressed on their slide mounts. The species was distinguished from *nonnae* by head length, head constriction behind eyes and numbers of fore wing setae, but comparisons of head length and shape based on compressed specimens are not reliable. Moreover, comparisons of the number of fore wing setae between fully winged *leionotus* and short-winged *nonnae* are not valid.

- C. cornipennis (Fig. 57) was described from three poorly mounted females. It was differentiated from *leionotus* only by tiny differences in antennal segment ratios and setae lengths. The comparative data are based on insufficient specimens, and the measurements were from a female of *cornipennis* but the male of *leionotus*.

- C. taibaishanensis (Figs 54, 55) was described from two females and one male taken on grass. It was only briefly compared to *distinctus* and also to the incorrect original description of *kwanzanensis*.

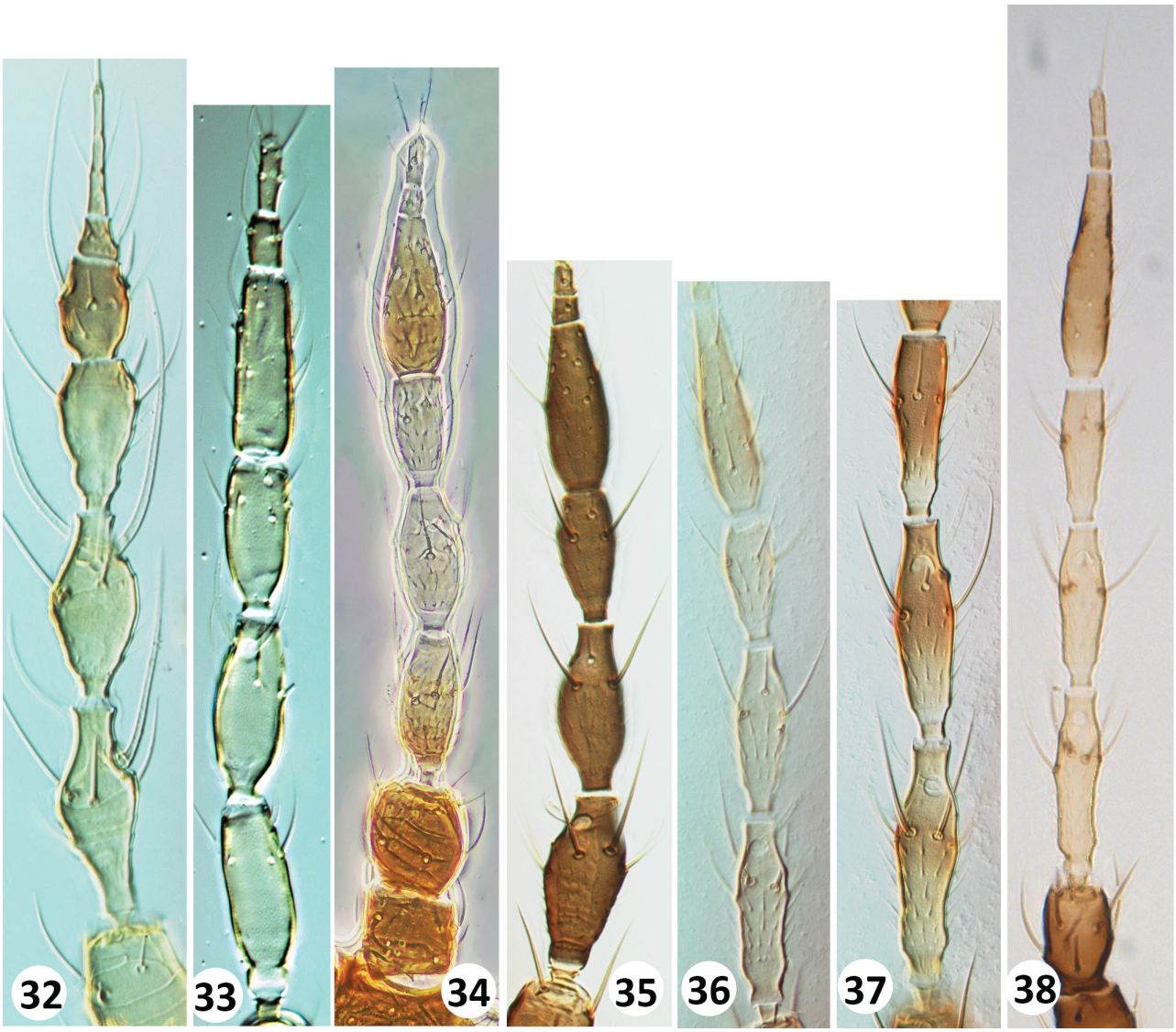
- C. guizhouensis (Fig. 58) was described from 21 females and distinguished from *kwanzanensis* on the basis of the original incorrect description. It was distinguished from *taibaishanensis* by having polygonally reticulate sculpture on the mesonotum, and abdominal sternite VII posteromarginal setae on the posterior margin. But the type specimens of both *guizhouensis* and *yangi* have abdominal sternite VII posteromarginal setae in front of the posterior margin. The specimens of all the names mentioned above have reticulate sculpture on the mesonotum, though these reticulations vary in size and shape between individuals.

- C. yangi was described from 19 females and 10 males, but the distinguishing characters given have been found to be largely unreliable when compared to more extensive collections.

In the key provided by Xie *et al*. (2011), the colour patterns of antennal segments and fore wings were used frequently, but those differences were derived from descriptions that were based on inadequate specimens. After studying considerably more specimens of this genus we consider that the colours are influenced by the maturity of individuals, together with the techniques used in slide-mounting. In the series of specimens of *yangi* from Yunnan (also *bridwelli* from Alberta and *distinctus* from Norway), variation in antennal and fore wing colour is readily observed (Figs 36–38). It seems that *kwanzanensis* and the six synonyms indicated represent a single common species that is widely distributed in mountain areas of China and Japan. Although *kwanzanensis* usually can be distinguished from *bridwelli* and *distinctus* by the characters given in the key above, there is still some overlap among these characters, with *bridwelli* occasionally having paler tibiae. Similarly, although *bridwelli* always has short ocellar setae III, individuals within a population from Québec were noted to have quite long ocellar setae III, especially the males. Therefore, there remains a possibility that the three names retained in the key above might represent a single widespread and variable species.

Material examined: **CHINA**, **Shaanxi**, Mt. Taibai, 1 female, 1 male from grass, 15.vii.2002 (G.L.Zhang); **Sichuan**, Pingwu, Baimaxiang, Wanglang National Nature Reserve (32°26'N, 104°22'E), 3 females from *Paeonia*, 1.viii.2016 (B.Q. Pan) (SCAU); Laohegou Nature Reserve (32°31'N, 104°41'E), 1 male from grass, 7.v.2013 (C. Zhao); **Chongqing**, Wushan, Liziping, alt. 1800m, 1 female, 19.v.1994 (J. Yao); **Hubei**, Shennongjia National Nature Reserve (31º29' N, 110º18'E), alt. 2200m, 2 females, 1 male from grass, 15.vii.1987 (S.P. Shen); 1 female from *Spiraea*, 28.vii.2014 (X.L. Tong); **Hunan**, Liuyang, Daweishan, Qixingling scenic region (28°26'N, 114°09'E), alt. 1500m, 1 male from *Lophatherum*, 16.viii.2016 (Z.H. Wang); **Guizhou**, Zunyi, 2 females from *Galium* flower

(Rubiaceae), 29.iv.2009 (H.R. Zhang); **Taiwan**, 1 female, vi.1936 (Takahashi); 1 female from Nantou, Tianchi, viii.1992 (C.L .Wang). **JAPAN**, Nagano Pref., Jiigatake, 1 female, 13.viii.1973 (K. Haga).



FIGURES 32–38. Antennae: **(32)** *H. aino*; **(33)** *Sc. cardamomi*; **(34)** *C. transeolineae*; **(35)** male of *V. smilax*; **(36)** *C. kwanzanensis* segments III–VI; **(37)** *C. kwanzanensis* segments III–V; **(38)** *C. kwanzanensis*.

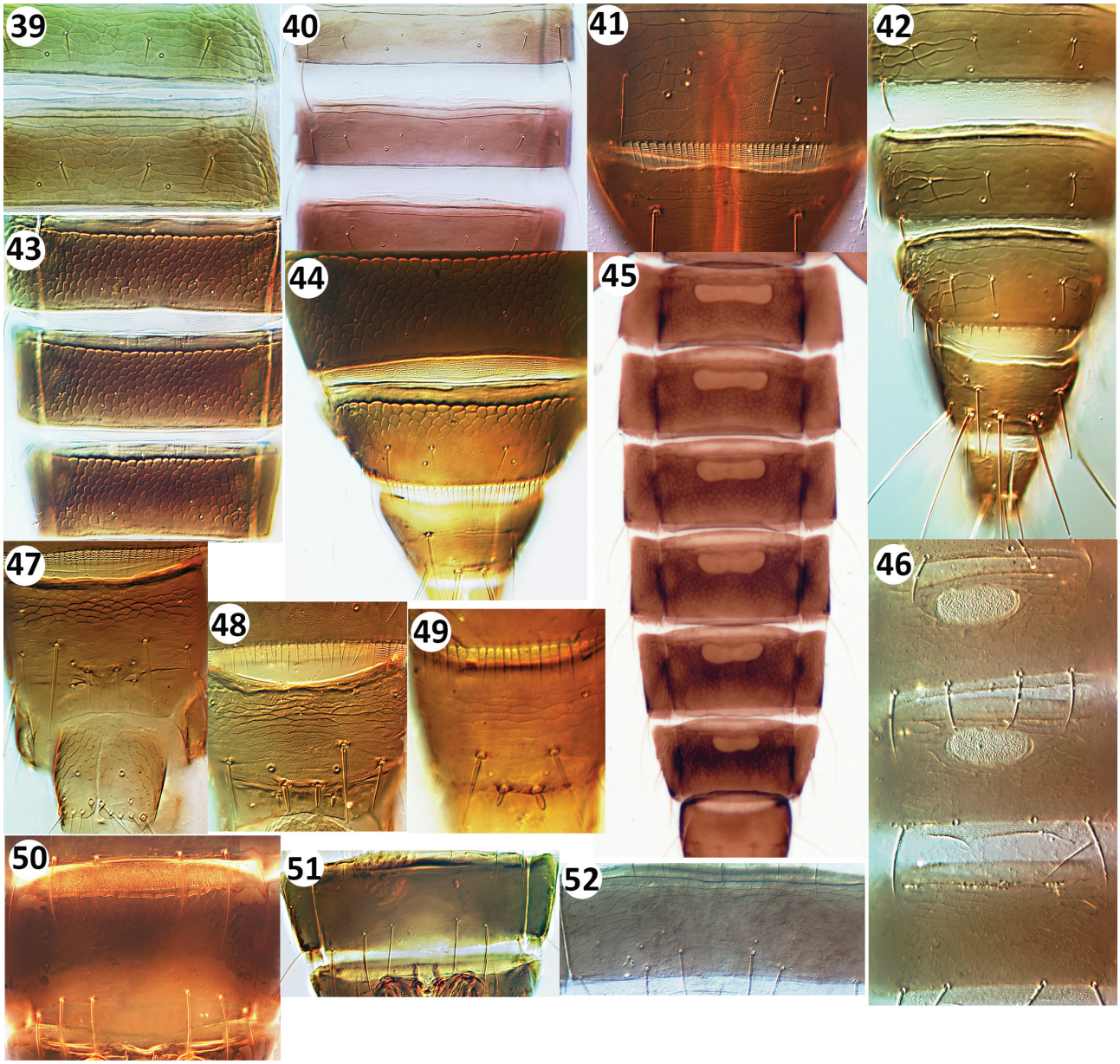
***Ctenothrips parisae* sp.n.**
(Figs 4, 19, 23, 30, 45, 48, 61–63)

Female macroptera. Body dark brown including legs, bases of femora and tibiae pale, tarsi pale; antennal segments I–II dark brown, III–V and the basal third of VI yellow, apex of VI and VII brown, VIII yellow; fore wings pale brown with basal fifth paler and sub-base darker. Head longer than wide (Fig. 4), with distinctly elongate reticulations behind eyes; ocellar setae III arising between posterior ocelli, as long as length of eyes; postocular setae 4 pairs arising almost in a row, with pair III slightly ahead row, all these setae shorter than ocellar setae III. Antennae 8-segmented, typical of the genus. Pronotum wider than long, without obvious sculpture, 0–3 pairs of discal setae present medially, 2 pairs of long posteroangular setae, posterior margin generally with 1 pair of setae (Fig. 19). Fore wing first setal row almost complete, setae closely spaced in sub-basal area, but more widely spaced in distal half; first vein with 26–30 setae, second vein with 21–25 setae, clavus with 5+1 setae (Fig. 30). Abdominal tergite I fully reticulate with median setae short, campaniform sensilla close to posterior margin; tergites II–VII almost fully polygonally reticulate, but area close to posterior margin almost smooth; tergite VIII reticulate anteriorly and later-

ally, posteromarginal comb complete, a few microtrichia present in front of spiracle; tergite IX with no reticulation; tergite X with weak reticulation, median longitudinal split complete. Abdominal sternites fully reticulate, sternite VII posteromarginal setae S1 and S2 arising in front of margin, with S1 further apart.

Measurements (holotype female in microns). Distended body length 2830. Head length 245, width across eyes 189, ocellar III length 106. Pronotum length 208, width 304; posteroangular setae length, inner 126, outer 126. Metanotum median setae length 70. Fore wings 1720. Antennal length 260; segments III–VIII length 102, 94, 76, 100, 14, 20.

Male *macroptera*. Similar to female, abdominal tergite VIII with posteromarginal comb complete; tergite IX with two pairs of short stout setae (Fig. 48), anterior pair longer than posterior pair; sternites III–VIII each with a transverse pore plate, about 85–115 microns wide and 30 microns long (Fig. 45).



FIGURES 39–52. Characters on abdomen. 39–40 Tergites: **(39)** *Ta. orionis* tergites III–IV; **(40)** *Ta. eucharii* tergites IV–VI; **(41)** *V. shennongjiaensis* tergite VIII; **(42)** *Te. frici* tergites VI–X; **(43)** *C. kwanzanensis* tergites V–VII; **(44)** *C. distinctus* VII–IX. 45–46 Male sternites: **(45)** *C. parisae*; **(46)** *V. shennongjiaensis*. 47–49 Male tergites IX: **(47)** *C. kwanzanensis*; **(48)** *C. parisae*; **(49)** *C. transeolineae*. 50–52 Sternites: **(50)** *C. bridwelli*; **(51)** *Ta. picipes*; **(52)** *V. shennongjiaensis*.

Measurements (paratype male in microns). Distended body length 2570. Head length 245, width across eyes 203; ocellar setae III length 119. Pronotum median length 301, width 210; posteroangular inner setae 92, outer 86.

Metascutum median setae length 38. Fore wings 1340. Antennal segments III to VII length as followings: 76, 72, 54, 84, 14, 22.

Material studied. Holotype female, **CHINA**, **Yunnan**, Lijiang (26º51' N, 100º13'E), from leaves of *Paris yunnanensis* (Fig. 63), 25.ix.2017 (Huang Hua). Paratypes: 22 females and 4 males, collected with holotype. Type specimens are deposited in YAU, 1 female and 1 male paratype in ANIC.

Etymology. The species is named after the plant on which it was collected.

Comments: This species is closely similar to *kwanzanensis* in body structure and color but differs in having a larger body size, about 2.8 mm long, pronotum generally with one pair of posteromarginal setae and male tergite IX with two pairs of short stout thorn-like setae. In contrast, the females of *kwanzanensis* are about 1.9–2.3 mm long; pronotum generally with two pairs of posteromarginal setae and male without thorn like setae on tergite IX. The male of this species is also similar to *transeolineae* in having thorn-like setae on tergite IX. It can be distinguished from that species by the 4 pairs of postocular setae arising almost in a row, ocellar setae pair III arising within the ocellar triangle and the pronotum is rather smooth (Fig. 19).

Ctenothrips transeolineae Chen

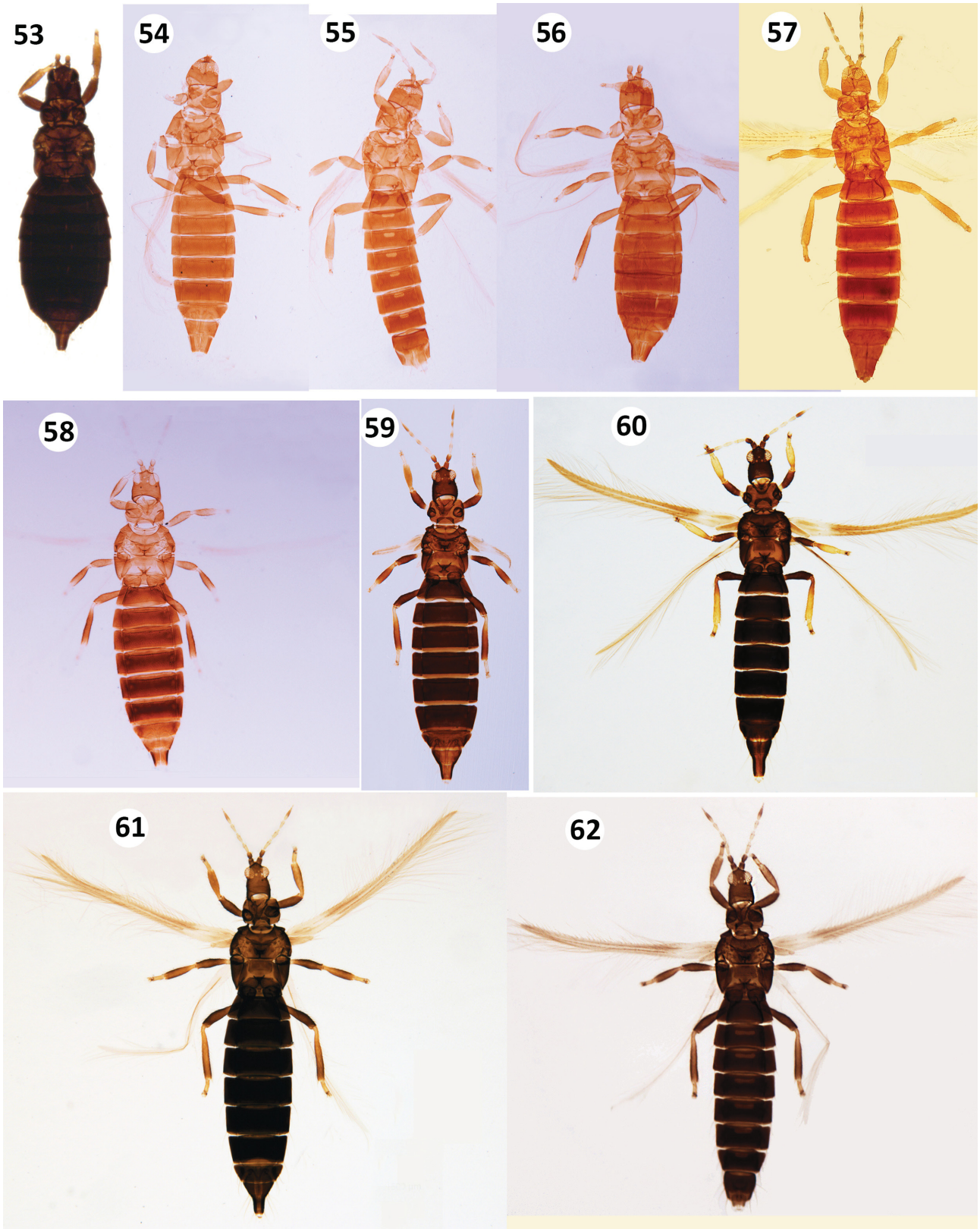
Ctenothrips transeolineae Chen, 1979: 184.
Ctenothrips barapatharensis Tyagi, Ghosh & Kumar, 2014: 274. **Syn.n.**
(Figs 5, 16, 18, 34, 49, 60)

Described from Taiwan, *transeolineae* remains known from only two males and one female. A rare condition for these specimens is having antennal segment III brown in the basal half and pale in the apical half, because most Thripidae have the distal parts of antennal segments darker than the basal parts. However, these specimens were poorly mounted with the mountant deteriorated, which might affect the antennal colour.

Ctenothrips barapatharensis was described from three females from Himachal Pradesh, India, and was distinguished from *transeolinae* by head with a dark thickening attached to the fore ocellus (*transeolinae* without); pronotal posterior margin with 2 pairs of setae (*transeolinae* with 1 pair); distance between median pair of metanotal setae subequal to the distance between median and submedian (*transeolinae* with median setae close to submedian setae); abdominal tergites I–VII smooth at posterior margin (tergites I–VII reticulated at posterior margin)(Tyagi 2014). However, the dark thickenings attached to the fore ocellus is a convexity created by slide-mounting, and this can be seen in almost all specimens of *Ctenothrips*, including *bridwelli* (Fig. 13), *distinctus* (Fig. 3) and *parisae* (Fig. 4). Comparing the head illustrations of *barapatharensis* and *transeolinae*, there are no differences in the postocular setae. The types of *transeolinae* also have smooth areas posterior to the campaniform sensilla on abdominal tergites I–VII. The distance between the median pair of metanotal setae and distance between the median and submedian setae varies among specimens. According to the specimens checked below, the distance between the median pair of metanotal setae and distance between the median and submedian setae varies; the number of pronotal posteromarginal setae can be one to two pairs, and the color of antennal segments III–V varies from completely pale to pale with brown shading on distal half. Therefore, we conclude here that *barapatharensis* is a synonym of *transeolinae*.

Diagnosis of males: similar to females but smaller, with one pair of short stout setae on tergite IX (Fig. 49); sternites III–VIII each have a transverse pore plate, width about 40–70 microns.

Material examined: CHINA, **Taiwan**, Taipei, Chutyuhu, 1 paratype female and 1 paratype male from grass, 8.vii.1978 (L.S. Chen); **Yunnan**, Lüchun county, Mt. Huanglian, 2 females from *Melastoma candidum*, 13.iii.2017 (H.R. Zhang); Pingbian county, Mt. Dawei, 2 females from *Aceraceae fabri*, 17.v.2017 (H.R. Zhang); 2 females from ferns and 7 females from *Physaliastrum japonicum*, 13.v.2017 (H.R. Zhang); Tonghai County, Xiushan Park, 4 females 5 males from *Tradescantia fluminensis*, 21.v.2017 (B. Kong). **INDIA**, **Uttar Pradesh**, Rangarh, alt. 2000m, 1 female, 9.x.1979 (I. Löbl); West Bengal, Darjeeling District, Tigerhill, alt. 2600m, 1 female 2 males, 18.x.1978 (I. Löbl). **NEPAL** (all collected by I. Löbl), Manang District, Marsyandi, alt. 2200m, 2 females, 12.iv.1980; Kathmandu, Phulchoki, 1 female, 28.iv.1984; 1 female, 14.x.1983; Province Bagmati, Tare Pati, alt. 3300m, 3 females, 1 male, 11.iv.1981; Phulchauki, 1 female, 10.v.1981; Mare Dara, 1 female, 7.iv.1981; Parbat District, Goropani, alt. 2700m, 1 female, 6.x.1983.



FIGURES 53–62. *Ctenothrips*. **(53)** *bridwelli* (Holotype of *frosti*). 54–59 *kwanzanensis*: **(54)** paratype female of *taibaishanensis*; **(55)** paratype male of *taibaishanensis*; **(56)** paratype of *leionotus*; **(57)** paratype of *cornipennis*; **(58)** paratype of *guizhouensis*; **(59)** paratype of *nonnae*. **(60)** *transeolineae*. 61–62 *parisae*: **(61)** female; **(62)** male.

Vulgatothrips Han

Vulgatothrips Han, 1997: 543. Type species: *V. shennongjiaensis* Han.

This genus was erected for a single species based on three females collected from a mountainous area of south west China. The slide mounts of these females are all of poor quality, with the specimens severely crushed. Zhang *et al*. (2018) concluded that this species is similar to some *Ctenothrips* species but lacks strong reticulate sculpture. According to the analysis here, *dissimilis*, *niger*, *smilax* and *shennongjiaensis* form a single, well supported clade, and they are thus treated as congeneric.

***Diagnosis*:** Female macropterous or micropterous. Head without obvious projection in front of eyes; maxillary palps 3-segmented; eyes with no pigmented facets; ocellar setae I present, ocellar setae III arise within ocellar triangle (Fig. 14). Antennae 7- or 8-segmented, segment I without paired dorso-apical setae, III and IV with forked sense cones. Pronotum wider than long, with few transverse sculpture lines; two pairs of long posteroangular setae and two pairs of posteromarginal setae present; anteromarginal setae distinctly longer than discal setae. Mesonotum anterior campaniform sensilla close together. Metanotum reticulate, median setae close to anterior margin or behind margin (Fig. 20). Mesosternum with spinula, metasternum without (Fig. 26). Tarsi 2-segmented. Fore wing, when present, with first vein setal row almost complete, second vein with complete row; clavus with 5 veinal setae. Tergites extensively reticulate without craspedum or ctenidia; tergite VIII with complete posteromarginal comb, with a few microtrichia anterior to spiracles. Sternite VII setae S1 & S2 arise in front of margin (Fig. 52). Male with pore plates on sternites III–IV (Fig. 46).

Key to *Vulgatothrips* species

1. Antennae 7-segmented, segments III–IV pale; [postocular setae situated in transverse row, pair I absent; metanotal median setae arising well behind anterior margin, usually with campaniform sensilla] . . . . . *dissimilis*
-. Antennae 8-segmented, antennal segments almost uniformly dark brown (Fig. 35). 2

2. Postocular setae situated in transverse row (Fig. 14); metanotal median setae arising close to margin, campaniform sensilla usually absent (Fig. 20) . . . . . *shennongjiaensis*
-. Postocular setae not situated in transverse row, pair I arising ahead of setal row (Fig. 6); metanotal median setae far behind anterior margin, campaniform sensilla present. . . . . *smilax*

Vulgatothrips dissimilis (Hu & Feng) Comb. n.

Ctenothrips dissimilis Hu & Feng, 2014: 263.
(Figs 7, 64)

This species was found in the southern mountain areas of Shaanxi Province, China. Although distinguished by the 7-segmented antennae, it shares the following character states with *V. shennongjiaensis*: postocular setae arising in a transverse row, pair I usually absent, pair IV longest; weak reticulation on relatively paler body surface. These two species were found in the same series of mountains, and their relationships require further study.

Material examined: **CHINA**, **Shaanxi**, Mt. Taibai, alt. 2250m, 1 paratype female collected from weeds, 15.vii.2002 (G.L. Zhang) (NWAFU).

Vulgatothrips shennongjiaensis Han

Vulgatothrips shennongjiaensis Han, 1997: 544.
(Figs 14, 20, 41, 46, 52, 65, 66)

This species was described from only three females, 1 macroptera and 2 micropterae, taken in southwest China. Here, more females and males are recorded from Sichuan. The males are similar to the females, but the tergal reticu-

lations are weaker, the comb on tergite VIII is shorter, and abdominal sternites III–IV each have a small pore plate about 20 microns long and 45 microns wide (Fig. 46). These specimens generally have postocular setae pair I absent, metanotal campaniform sensilla absent, and pronotum without discal setae. However, there is some variations in these character states, with postocular pair I sometimes present, one campaniform sensilla present on metanotum, and pronotum with a few discal setae.

Material examined: CHINA, **Sichuan**, Pingwu, Baimaxiang, Wanglang National Nature Reserve (32°26'N, 104°22'E), 2 females 2 males collected from Urticaceae and Balsaminaceae, 2.viii.2016 (B.Q. Pan) (SCAU).

FIGURE 63. *Ctenothrips parisae* larvae feeding on *Paris yunnanensis*

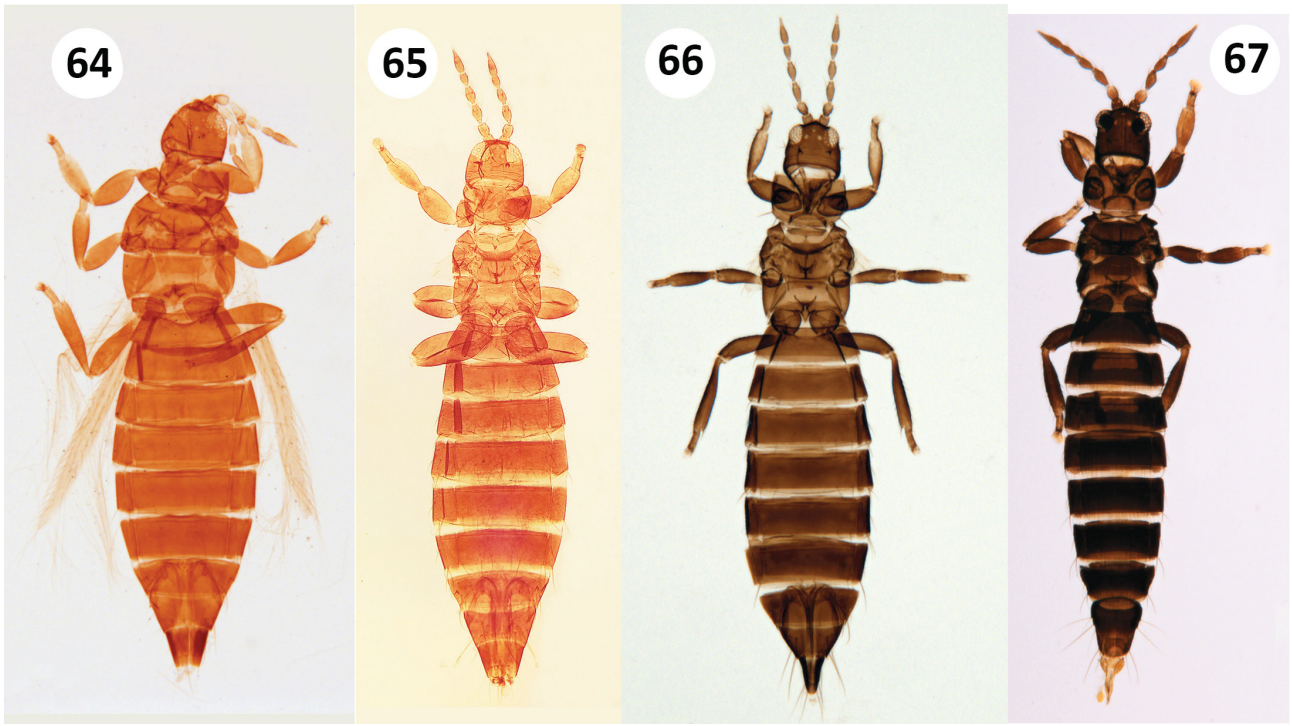
Vulgatothrips smilax (Bhatti) Comb. n.

Ctenothrips smilax Bhatti, 1976: 317.
Ctenothrips niger Kudô, 1977: 1. **Syn. n.**
(Figs 6, 26, 35, 67)

The species *smilax* was described originally from five brachypterous specimens in Himachal Pradesh and Jammu & Kashmir in India. Kudô (1977) described *niger* from Nepal based on three macropterous females without referring to *smilax*. Since then, the differences between these species have been based solely on original descriptions: *niger* is macropterous, with antennal segments dark brown and abdominal tergites I–VII hexagonally reticulate; while *smilax* is brachypterous, with antennal segments brown and abdominal tergites V–VI with extremely faint reticulation, smooth in about posterior half and no reticulations on VII (Bhatti 1976; Chen 1979; Xie *et al*. 2011). However, the distinction of "dark brown" or "brown" antennae is not a secure difference, and the original description of *smilax* also pointed out distinct reticulation present on tergites V–VIII in a female. Tyagi (2014) identified as *niger* some brachypterous specimens in India and noted variation in the position of the metanotal median setae and campaniform sensilla. Similar variation was observed by Hu & Feng (2014), with the description of males and the frequent variation in wing length. Hu & Feng (2011) also recorded the distribution of *smilax* in China, with males having a pore plate on abdominal sternites III–V. However, in the present study we examined two males of *smilax* identified by Bhatti that were collected from the same plant and at the same location and almost the same time as the paratypes of this species. These males have a large pore plate only on abdominal sternites III–IV instead of III–V. Moreover, these two males have normal antennal segment VI, with fewer setae on the distal half, while the males identified as *smilax* from China by Hu & Feng (2011) have antennal segment VI longer with more setae, and some setae situated on the basal half. Moreover, the length of tergite I median setae S1 of this species is also variable, two males

collected by Bhatti have quite long median setae on tergite I, and one female from Nepal has these setae short and small. Among specimens collected in China, the length of these setae varies within populations from about 0.25 to 0.5 of the length of tergite I (Zhang SM, *pers. comm.* 2018). All the former descriptions failed to mention the meso-sternopleural sutures, but according to the specimens observed in this study, weak meso-sternopleural sutures are present, and of the three brachypterous specimens from India, one has a weakly developed suture on one side (Tyagi K, *pers. comm*. 2018). Therefore *niger* is here considered a synonym of *smilax*, and the diagnosis of *smilax* is as follows: female macropterous, brachypterous or micropterous, head with ocellar setae I present (Fig. 6), postocular setae pair I present and situated ahead of setal rows; antennae completely brown with base of segment III sometimes slightly paler (Fig. 35); metanotal median setae close to anterior margin or behind margin, campaniform sensilla situated in the middle or on posterior third; mesosternal sternopleural sutures present (Fig. 26); tergites hexagonally reticulate but rather smooth near posterior margin; male with pore plate on abdominal sternites III–IV and antennal segment VI with all setae arising in distal half.

Material examined: CHINA, Yunnan, Mt. Ailao, Alt. 2460m, 1 female from Asteraceae 10.vi.2011 (Q.L. Hu) (NWAFU). **NEPAL,** Parbat Distr., Goropani, 2750m, 1 female, 5.x.1983 (I. Löbl) (SMF). **INDIA**, **Bhaderwah**, 2 males from fern, 2.vi.1976 (J.S. Bhatti) (BMNH & SMF).



FIGURES 64–67. *Vulgatothrips*. **(64)** paratype of *dissimilis*; **(65)** paratype of *shennongjiaensis*; **(66)** *shennongjiaensis*; **(67)** male *of smilax*.

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Appendix 1. Information of specimens checked for the phylogenetic analysis

Species	Depository	Locality	Specimens checked	Associated plants	Plant family	Types
Helionothrips aino	ANIC	Timor	22♀	*Colocasia; Xanthosoma*	Araceae Araceae	
	SCAU	Guangdong, China	1♀1♂	?	Poaceae	
Ayyaria chaetophora	ANIC	QLD, Australia	9♀	*Calopogonium*	Fabaceae	
			1♂	*Ageratum*	Asteraceae	
		Timor	1♀	*Glycine*	Fabaceae	
Amomothrips associatus	ANIC	Yunnan, China	1♀	*Alpinia*	Zingiberaceae	
		Malaysia	1♂	*Alpinia*	Zingiberaceae	
Ctenothrips barapatharensis	ANIC	Yunnan, China	1♀	?	Aceraceae	
			1♀	*Melastoma*	Melastomataceae	
			2♂	*Tradescantia*	Commelinaceae	
	SMF	Nepal	10♀	?	?	
		Darjeeling, India	1♀2♂	?	?	
		Uttar Pradesh, India	1♀	?	?	
Ctenothrips bridwelli	ANIC	Quebec, Canada	4♀4♂	*Epipactis*	Orchidaceae	
			1♀	*Trillium*	Melanthiaceae	
		TN, USA	1♀	?	?	
	UASM	Alberta, Canada	12♀4♂	*Lilium*	Liliaceae	
	NMNH	NY and MD, USA	3♀1♂	*Lilium;*	Liliaceae	
		CN, TN, NY	4♀	?	?	
		TN, IL, MD	10♀	*Trillium*	Liliaceae	
		VT	2♀	*Caulophyllum*	Berberidaceae	
		MS	1♀	Skunk cabbage	Araceae	
		IL	4♀	Green-dragon	Araceae	
		NY	2♀	*Podophyllum*	Berberidaceae	
		NY	1♀	*Polygonatum*	Asparagaceae	
Ctenothrips cornipennis	NZMC	Chongqing, China	1♀	?	Weeds	Paratype
Ctenothrips distinctus	ANIC	Poland	2♀	?	?	
		Vladivostok, Russia	2♀	*Urtica*	Urticaceae	
		Korea	3♀1♂	*Lilium*	Liliaceae	
	JLU	Jilin, China	2♀1♂	*Rhododendron*	Ericaceae	
	S. Kobro Coll.	Norway	14♀5♂	*Convallaria*	Asparagaceae	
			8♀2♂	?	?	
	SMF	Austria	2♀	*Convallaria*	Asparagaceae	
		Germany	2♂	*Convallaria*	Asparagaceae	
Ctenothrips frosti	CAS	MS, USA	1♀	?	?	Holotype
Ctenothrips leionotus	SCAU	Hubei, China	2♀1♂	?	Poaceae	Types
Ctenothrips guizhouensis	ANIC	Guizhou, China	2♀	*Galium*	Rubiaceae,	Paratype

....Continued next page

Appendix 1. (Continued)

Species	Depository	Locality	Specimens checked	Associated plants	Plant family	Types
Ctenothrips kwanzanensis	TARI	Taiwan, China	2♀	?	Weeds	Types
	SCAU	Hubei, China	1♀	*Spiraea*	Rosaceae	
		Sichuan, China	2♀	*Paeonia*	Paeoniaceae	
		Sichuan, China	2♀1♂	?	Poaceae	
		Hunan, China	1♂	*Lophatherum*	Poaceae	
Ctenothrips nonnae	ANIC	Japan	1♀	*Paris*	Liliaceae	Paratype
	JLU	Jilin, China	2♀1♂	*Paris*	Liliaceae	
Ctenothrips parisae sp.n.	ANIC	Yunnan, China	1♀1♂	*Paris*	Liliaceae	Paratype
Ctenothrips taibaishanensis	NWAFU	Shaanxi, China	1♀1♂	?	Weeds	Paratype
Ctenothrips transeolineae	TARI	Taiwan,China	1♀1♂	?	Poaceae	Paratype
Ctenothrips yangi	YAU	Yunnan, China	1♀	*Pilea*	Urticaceae	Holotype
			1♀2♂	*Oxalis*	Oxalidaceae	Paratype
Ctenothrips dissimilis	NWAFU	Shaanxi, China	1♀	?	Weeds	Paratype
Ctenothrips niger	SMF	Nepal	1♀	?	?	
Ctenothrips smilax	SMF & BMNH	Bhaderwah, India	2♂	?	Ferns	
Sciothrips cardamomi	ANIC	Hawaii	1♀1♂	*Hedychium*	Zingiberaceae	
		Brazil	3♀	*Zantedeschia*	Araceae	
Smilothrips productus	ANIC	Sichuan, China	1♀	*Carex*	Cyperaceae	
Taeniothrips damansarae	ANIC	Malaysia	1♀1♂	*Curculigo*	Hypoxidaceae	Paratype
		Malaysia	1♀2♂	*Phaeometria*	Zingiberaceae	
Taeniothrips eucharii	ANIC	Hunan, China	3♀2♂	*Ophiopogon*	Asparagaceae	
		NSW, Australia	3♀	*Hymenocallis*	Amaryllidaceae	
Taeniothrips major	ANIC	Pakistan N.W.	5♀	*Impatiens*	Balsaminaceae	
Taeniothrips picipes	ANIC	France	1♀	*Solidago*	Asteraceae	
Taeniothrips inconsequens	ANIC	England	1♀	*Quercus*	Fagaceae	
		France	1♀	*Prunus*	Rosaceae	
Taeniothrips orionis	ANIC	Alaska	3♀5♂	?	Paeoniaceae	
		Oregon, USA	1♀1♂	?	?	
Tenothrips frici	ANIC	QLD, Australia	10♀3♂	*Hieraceum*	Asteraceae	
			4♀2♂	?	Grass	
Vulgatothrips shennongjiaensis	NZMC	Chongqing, China	1♀	?	?	Paratype
	SCAU	Sichuan, China	1♀1♂	?	Urticaceae	
			1♀1♂	?	Balsaminaceae	

Appendix 2. Morphological characters coded in the phylogenetic analysis.

0. Head: (0) obvious wider than long, length/width <0.8 (Fig. 8); (1) not obvious wider than long, length/width >=0.8 (Fig. 4).
1. Head projection between eyes: (0) absent (Fig. 10); (1) present (Fig. 5).
2. Eye length/cheeks length: (0) <0.8 (Fig. 4); (1) 0.8–1.2; (2) >1.2 (Fig. 12).
3. Eye pigmented facets: (0) absent; (1) present.
4. Anterior ocellar setae: (0) 1 pair (Fig. 5); (1) 2 pairs (Fig. 6); (2) 3 or 4 pairs.
5. Ocellar setae III apex: (0) pointed; (1) not pointed (Fig. 9).
6. Ocellar setae III length: (0) almost as long as setal basal distance (Fig. 3); (2) longer than setal basal distance (Fig. 2).
7. Ocellar setae III length compare to distance between hind ocelli: (0) shorter (Fig. 13); (1) as long as (Fig. 12); (2) longer (Fig. 11).
8. Ocellar setae III base distance compare to distance between hind ocelli: (0) obvious shorter (Fig. 11); (1) not obvious shorter (Fig. 12).
9. Ocellar setae III position: (0) in front of hind ocelli (Fig. 12); (1) on anterior margin of hind ocelli (Fig. 10); (2) between hind ocelli (Fig. 14); (3) on posterior margin (Fig. 15); (4) behind ocelli.
10. Postocular setae: (0) almost situated in a row (Fig. 4); (1) not situated in a row (Fig. 5).
11. Postocular setae number: (0) 4 pairs; (1) 5 pairs; (2) 6 pairs (Fig. 5, 15).
12. Postocular setae length: (0) equal; (1) unequal.
13. Longest postocular setae compared to ocellar setae III: (0) shorter; (1) as long as; (2) longer.
14. Maxillary palps: (0) 2 segmented; (1) 3 segmented.
15. Antennae: (0) 7-segmented; (1) 8-segmented.
16. Microtrichia on antennae: (0) absent; (1) present only ventrally; (2) present dorsally and ventrally.
17. Antennal segment I dorso-apical setae: (0) absent; (1) present.
18. Antennal IV sense cone length: (0) less than half segment; (1) as long as or longer than half; (2) almost as long as segment; (3) longer than segment (Fig. 32).
19. Antennal VI length: (0) shorter than V (Fig. 32); (1) longer than V (Fig. 33–37).
20. Antennal VI setae position: (0) all on distal half (Fig. 35); (1) basal half with setae (Fig. 36).
21. Pronotum sculpture: (0) fully polygonally reticulate; (1) fully transverse lines (Fig. 12); (2) weak reticulation (Fig. 13); (3) few transverse lines (Fig. 17); (4) smooth (Fig. 19).
22. Pronotum discal setae: (0) none (Fig. 10); (1) 1–10 (Fig. 13); (2) >10 (Fig. 12).
23. Pronotal anteromarginal prominent long setae: (0) absent (Fig. 11); (1) present (Fig. 10).
24. Pronotal posteromarginal setae: (0) 0 pair; (1) 1 pairs (Fig. 10); (2) 2 pairs; (3) 3 pairs (Fig. 11); (4) 4 pairs; (5) 5 pairs.
25. Pronotal posteromarginal prominent long setae: (0) absent; (1) present (Fig. 11).
26. Pronotal posteroangular long setae: (0) absent; (1) 2 pairs equal long setae (Fig. 19); (2) 2 pairs of long setae, but inner pair longer than outer pair.
27. Mesonotal sculpture: (0) transverse; (1) transverse reticulate (Fig. 20); (2) polygonally reticulate.
28. Mesonotal anterior CPS: (0) absent; (1) present (Fig. 21).
29. Metanotal sculpture: (0) longitude; (1) reticulate (Fig. 21); (2) absent medially; (3) raised triangle.
30. Metanotal median setae: (0) on or close to anterior margin (Fig. 20); (1) behind anterior margin (Fig. 21); (2) close to posterior margin.
31. Metanotal median setae length compare to submedian setae length: (0) shorter; (1) as long as (Fig. 21); (2) longer (Fig. 20).
32. Metanotal CPS: (0) absent (Fig. 20); (1) present (Fig. 21).
33. Metanotal CPS position: (0) in middle (Fig. 23); (1) on posterior third.
34. Mesosternal suture: (0) absent (Fig. 24); (1) present (Fig. 25); (2) present but not complete (Fig. 26).
35. Metasternal furca: (0) enlarged; (1) normal.
36. Mesosternal furca spinula: (0) absent (Fig. 24); (1) present (Fig. 25).
37. Metasternal furca spinula: (0) absent (Fig. 24); (1) present.
38. Fore wing first vein setal row: (0) complete or almost complete (Fig. 31); (1) with long gap (Fig. 29).
39. Fore wing second vein: (0) with a few setae; (1) with complete setal row (Fig. 29).
40. Fore wing clavus: (0) 3 vein setae; (1) 4 vein setae; (2) 5 or 6 vein setae with 1 discal setae.
41. Tergite I sculpture: (0) fully strongly reticulate; (1) fully sculptured but not strongly reticulate; (2) not fully sculpture.

42. Tergite sculpture: (0) transverse (Fig. 42); (1) reticulate (Fig. 43).
43. Tergite sculpture between S1: (0) absent (Fig. 42); (1) present.
44. Tergite sculpture between S2: (0) absent (Fig. 40); (1) present.
45. Tergite sculpture behind CPS: (0) absent (Fig. 44); (1) present.
46. Tergite craspedum: (0) absent; (1) present (Fig. 42).
47. Tergite VIII comb condition: (0) complete (Fig. 41); (1) not complete (Fig. 42).
48. Tergite VIII comb shape: (0) long and fine (Fig. 41); (1) short comb (Fig. 42).
49. Tergite VIII comb: (0) arising from margin (Fig. 41); (1) arising from craspedum.
50. Microtrichia in front of spiracle on tergite VIII: (0) absent; (1) present.
51. Tergite VIII length: (0) shorter than VII; (1) as long as VII; (2) longer than VII.
52. Tergite IX length: (0) shorter than VIII; (1) as long as VIII; (2) longer than VIII.
53. Tergite X length: (0) shorter than IX; (1) as long as IX; (2) longer than IX.
54. Tergite IX CPS: (0) absent; (1) 1 pair; (2) 2 pairs.
55. Tergite IX posterior margin with an additional setae between median setal pair: (0) absent (Fig. 42); (1) present.
56. Tergite X split: (0) complete (Fig. 42); (1) present but not complete; (2) absent.
57. Sternite craspedum: (0) absent; (1) present.
58. Sternite II posterior margin setae: (0) 2 pairs; (0) 3 pairs.
59. Sternite VII posterior margin setae: (0) 2 pairs; (1) 3 pairs (Fig. 51).
60. Sternite VII median setae S1: (0) slightly in front of margin; (1) far ahead of margin (Fig. 50).
61. Sternite VII submedian setae S2: (0) on margin; (1) in front of margin but behind S1(Fig. 52); (2) in a transverse line with S1.
62. Sternite VII S2: (0) close to S1 (Fig. 52); (1) in middle between S1 and S3 (Fig. 50); (2) close to S3.
63. Sternite VII posterior small setal pairs: (0) well developed; (1) minute or invisible.
64. Male tergite VIII comb: (0) absent; (1) present (Fig. 49).
65. Male tergite IX median setae: (0) 2 pairs of stout setae arising from projection; (1) 2 pairs of stout setae (Fig. 48); (2) 1 pair of stout setae (Fig. 49); (3) setae normal, not stout (Fig. 47).
66. Male tergite IX: (0) 2 longitudinal rows of small tubercles present; (1) no tubercles (Fig. 49).
67. Male sternal pore plates: (0) absent; (1) VI–VII; (2) III–IV (Fig. 46); (3) III–VIII (Fig. 45).

Appendix 3. Morphological character matrix table.

Taxon	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Helionothrips aino	0	0	2	1	0	0	0	1	1	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1	0	0	0	2	1	3	2	0	1	0	0	0	0	0	1	0	1	2	1	1	1	0	1	1	0	1	0	1	0	1	1	0	1	0	0	1	?	1	1	2	1	0	1	0	0	1
Acremonothrips aethiops	1	0	2	0	0	?	1	2	0	?	?	?	?	?	1	1	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Amomothrips associatus	1	1	1	0	2	0	1	1	0	1	1	2	0	0	1	1	2	0	0	1	1	1	2	1	4	1	1	1	0	1	0	2	1	0	1	1	1	0	1	1	2	2	0	1	1	1	0	0	0	0	0	1	0	2	0	1	0	1	0	0	1	1	2	1	1	1	3	1	3
Ayyaria chaetophora	0	0	2	1	1	0	1	2	0	1	0	2	1	0	0	1	2	0	0	1	1	3	0	1	1	1	1	0	0	2	1	1	0	?	0	1	1	1	1	0	0	2	1	1	1	1	1	0	0	1	0	0	2	0	0	0	2	0	1	1	1	0	0	1	1	0	0	0
Ctenothrips barapatharensis	1	1	1	0	0	0	1	1	0	3	1	2	0	1	1	1	2	0	0	1	1	1	1	1	12	1	1	12	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	2	1	3
Ctenothrips bridwelli	1	01	1	0	0	0	1	012	0	12	0	1	0	1	1	1	2	0	0	1	1	2	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips cornipennis	1	01	1	0	0	0	1	2	0	1	0	1	0	0	1	1	2	0	0	1	1	3	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips dissimilis	1	0	1	0	1	0	1	1	0	2	0	1	1	2	1	0	2	0	0	1	0	3	1	1	2	1	1	2	1	1	1	12	1	1	1	1	1	0	0	1	2	0	1	1	1	1	0	0	0	0	1	0	0	2	1	0	0	0	0	1	1	1	0	1	1	3	1	2
Ctenothrips distinctus	1	01	1	0	0	0	1	01	0	12	0	1	0	1	1	1	2	0	0	1	1	2	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips frosti	1	01	1	0	0	0	1	0	0	2	0	1	0	1	1	1	2	0	0	1	1	2	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips guizhouensis	1	1	1	0	0	0	1	12	0	1	0	1	0	0	1	1	2	0	0	1	1	3	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips leionotus	1	1	1	0	0	0	1	2	0	1	0	1	0	0	1	1	2	0	0	1	1	3	1	1	12	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips kwanzanensis	1	01	1	0	0	0	1	2	0	1	0	1	0	0	1	1	2	0	0	1	1	3	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips niger	1	0	1	0	1	0	1	1	0	1	1	2	1	2	1	1	2	0	0	1	0	3	1	1	2	1	1	2	1	1	1	12	1	1	2	1	1	0	0	1	2	0	1	1	1	1	0	0	0	0	1	0	0	2	1	0	0	0	0	1	1	1	0	1	1	3	1	2
Ctenothrips nonae	1	1	1	0	0	0	1	2	0	1	0	1	0	0	1	1	2	0	0	1	1	3	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips parisae n. sp.	1	1	0	0	0	0	1	2	0	2	0	1	0	0	1	1	2	0	0	1	1	3	1	1	2	1	1	2	1	1	1	12	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	1	3
Ctenothrips smilax	1	0	1	0	1	0	1	1	0	1	1	2	1	2	1	1	2	0	0	1	0	3	1	1	2	1	1	2	1	1	1	2	1	1	2	1	1	0	0	1	2	0	1	1	1	1	0	0	0	0	1	0	0	2	1	0	0	0	0	1	1	1	0	1	1	3	1	2
Ctenothrips taibaishanensis	1	01	1	0	0	0	1	2	0	1	0	1	0	0	1	1	2	0	0	1	1	3	1	1	2	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Ctenothrips transeolineae	1	1	1	0	0	0	1	1	0	3	1	2	0	1	1	1	2	0	0	1	1	1	1	1	1	1	1	2	1	1	1	2	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	2	1	3
Ctenothrips yangi	1	1	1	0	0	0	1	2	0	1	0	1	0	0	1	1	2	0	0	1	1	3	1	1	12	1	1	2	1	1	1	1	1	0	0	1	0	0	0	1	2	0	1	1	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	1	1	1	1	1	3	1	3
Moundinothrips robustus	2	1	0	0	0	0	1	2	0	1	0	1	1	1	1	1	2	1	0	1	1	3	1	0	1	1	1	1	1	1	0	2	1	1	0	1	1	1	1	1	2	2	1	1	1	0	0	0	0	0	0	?	2	0	1	0	1	0	0	0	0	0	?	1	?	?	?	?
Sciothrips cardamomi	1	1	0	0	0	0	1	2	1	0	1	1	1	0	1	1	0	0	0	1	1	4	1	0	2	1	2	1	1	1	2	1	0	?	1	1	1	0	1	0	2	1	0	1	1	1	0	0	0	0	0	0	1	2	0	1	0	1	0	0	1	1	0	1	1	1	1	3
Smilothrips productus	2	1	0	0	0	0	1	1	0	1	1	2	0	0	1	0	2	0	0	1	0	3	0	0	2	1	1	1	1	1	1	2	0	?	1	1	0	0	1	1	2	?	1	1	1	0	1	0	0	0	0	0	0	2	0	1	0	0	0	0	1	1	1	1	1	?	?	?	?
Taeniothrips damansarae	1	1	2	0	0	1	1	2	0	1	0	2	1	0	1	1	2	0	0	1	1	1	2	0	2	1	1	1	0	1	0	2	1	0	1	1	1	0	1	1	2	2	0	0	0	0	0	0	0	0	0	1	1	2	0	1	0	1	0	0	1	1	1	1	1	1	3	1	3
Taeniothrips eucharii	1	1	2	0	0	0	1	2	0	1	0	12	1	0	1	1	2	0	0	1	1	3	2	0	23	1	1	1	1	1	0	2	1	0	1	1	1	0	1	1	2	2	0	0	0	0	0	0	0	0	0	1	0	2	0	1	0	1	0	0	1	1	1	1	1	1	3	1	3
Taeniothrips inconsequens	1	01	1	0	0	0	1	2	0	1	0	1	1	0	1	1	2	0	0	1	1	4	2	0	23	1	1	1	1	1	0	2	1	0	1	1	1	0	1	1	2	2	0	0	0	0	0	0	0	0	0	1	0	2	0	1	0	1	0	0	1	1	0	1	1	1	3	1	3
Taeniothrips major	1	1	1	0	0	0	1	2	0	1	0	1	1	0	1	1	2	0	0	1	1	4	2	1	23	1	1	1	1	1	0	2	1	0	1	1	1	0	1	1	2	2	1	1	1	1	0	0	0	0	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	3	1	3
Taeniothrips orionis	1	1	1	0	0	0	1	2	0	1	0	01	1	0	1	01	2	0	0	1	1	4	2	1	23	1	1	1	1	1	0	2	1	0	1	1	1	0	1	1	2	2	1	1	1	1	0	0	0	0	1	1	0	0	1	1	1	0	0	1	1	1	1	1	1	3	1	3
Taeniothrips picipes	1	0	2	0	0	0	1	2	0	1	0	2	1	0	1	1	2	0	0	1	1	3	2	0	3	1	1	1	1	1	0	2	1	0	1	1	1	0	1	1	2	2	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0	0	1	1	1	1	1	1	3	1	3
Tenothrips frici	0	0	2	1	1	0	0	1	1	0	0	2	0	0	1	1	2	0	0	1	0	1	2	0	45	1	1	1	1	1	0	2	0	?	1	1	1	0	1	1	2	1	0	0	1	0	0	1	1	1	1	2	0	1	1	0	0	0	0	0	1	1	0	1	1	0	3	1	3
Vulgatothrips shennongjiaensis	1	0	1	0	1	0	1	1	0	2	0	12	1	2	1	1	2	0	0	1	0	2	1	1	2	1	1	2	1	1	0	2	0	?	1	1	1	0	0	1	2	0	1	1	1	1	0	0	0	0	1	0	0	2	1	0	0	0	0	1	1	1	0	1	1	3	1	2

Appendix 4. Phylogenetic relationships of genera of *Taeniothrips* genus-group. Most parsimonious tree generated from morphological phylogenetic analysis.